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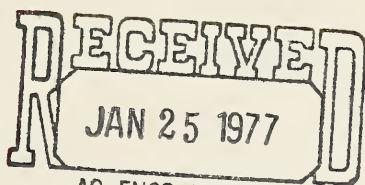


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ulletin 652T
January 1977



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no. 652T Studies on the Parasites
Associated with the
Alfalfa Weevil in West Virginia

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ABSTRACT

Alfalfa fields were surveyed in five of the six climatic regions of West Virginia to determine the distribution and incidence of parasites associated with the alfalfa weevil. Eleven species of parasites were reared from the various life stages of the weevil. *Bathyplectes curculionis* (Thomson) and *Microctonus colesi* Drea were the most prevalent parasites. Parasitism by *B. curculionis* was generally low, but at one location 88 percent of the weevil larvae yielded this parasite on one date. Parasitism by *M. colesi* ranged from 49 to 74 percent at several locations. *Bathyplectes anurus* (Thomson) is established at most release sites but is not numerous. Six species of Hymenoptera were reared from *B. curculionis* cocoons.

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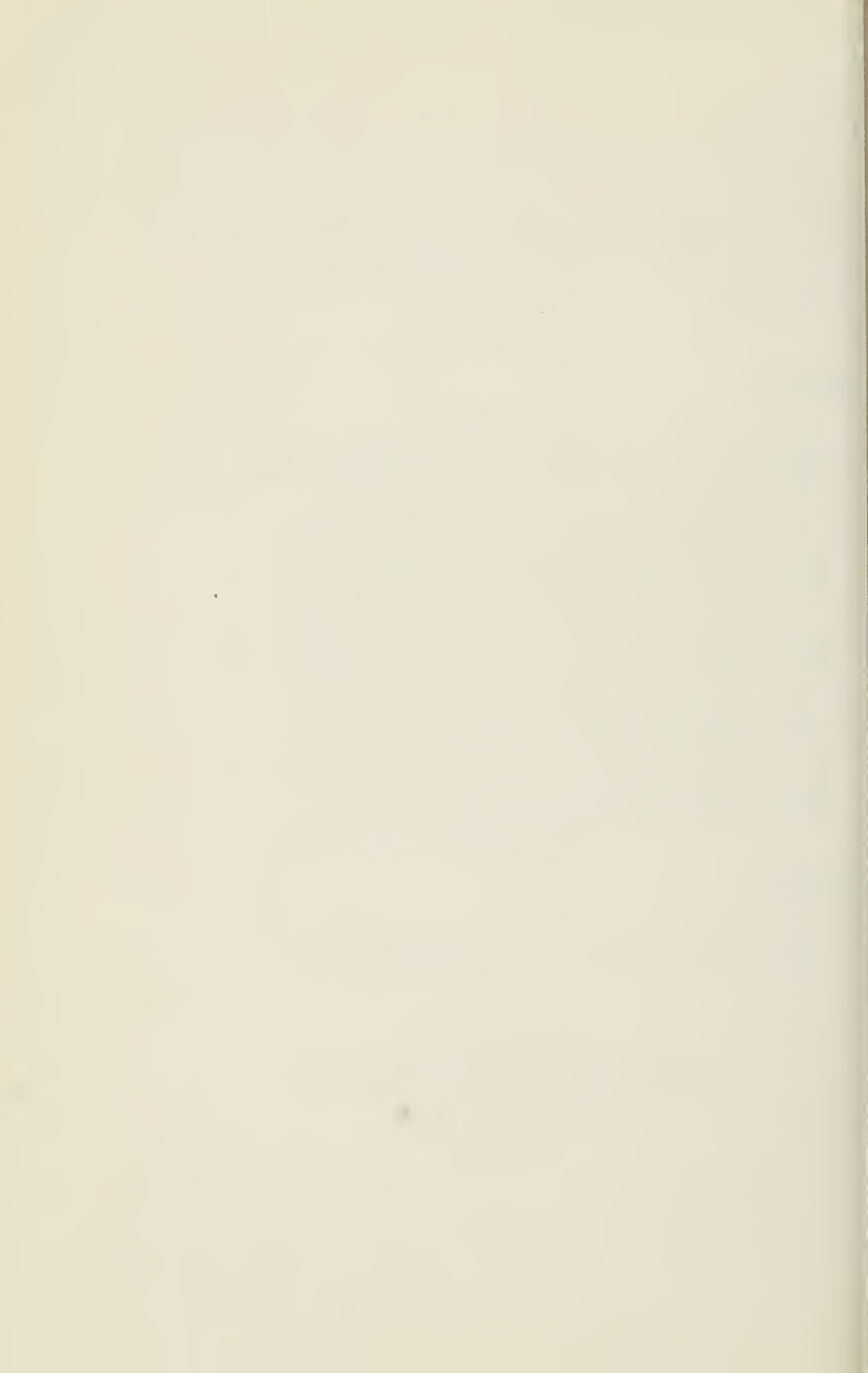
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Studies on the Parasites Associated With the Alfalfa Weevil in West Virginia

Joseph E. Weaver and Thomas S. Gallo

The alfalfa weevil, *Hypera postica* (Gyllenhal), was first reported in West Virginia by Poos in 1954. The first serious economic losses caused by the weevil in West Virginia occurred in Jefferson and Berkeley counties in 1955. By 1961, the weevil had spread into all of the alfalfa producing areas of the State. It remains the major insect pest of alfalfa in West Virginia and high populations continue to occur in many areas.

Initial efforts to establish parasites in West Virginia were made in 1961 and 1962 when colonies of *Bathyplectes curculionis* (Thomson) (Ichneumonidae), *Tetrastichus incertus* (Ratzeburg) (Eulophidae), and *Dibrachoides druso* (Walker) (Pteromalidae) were released. To our knowledge, no follow-up studies were conducted to determine establishment and spread of these parasites. In 1969, a program was begun to make additional releases and to determine the distribution and incidence of established parasites. This bulletin reports on the progress of the program since 1969, and in particular, the results of a more detailed study during 1972-73 of the parasites associated with the weevil in five regions of the State.

MATERIALS AND METHODS

Field samples of weevil adults and larvae, adult parasites and hyperparasites of *Bathyplectes* spp. were obtained by net sweepings, soil-debris collections, emergence cages, and the isolation of hand-picked *Bathyplectes* cocoons. Egg parasites were reared from weevil eggs collected from alfalfa stems.

Net sweepings consisted of 4 samples of 25 sweeps each from most alfalfa fields; when larval populations were low, 4 samples of 50 sweeps were made. A standard 15-in. diam. sweep net was used for sampling. To assess larval parasitism, 25 late instar larvae from each sample (100/field) were isolated in plastic petri dishes and allowed to mature; alfalfa bouquets and water were supplied as needed. Surviving adult weevils reared from larvae in petri dishes were held for extended periods of two to twelve weeks for parasite development and then dissected to determine the presence of *M. colesi*. Field captured adults were examined for parasites soon after collection.

To assess the overwintering weevil population for parasitization by *Microctonus* spp., adult weevils were collected from cages placed in alfalfa fields during late March and early April. The cages were constructed of a wooden frame covered with plastic screen and black polyethylene sheeting. Adult weevils were captured in quart Mason jars, fitted with inverted screen cones, attached to the top of the cages. Each cage covered four square feet. Adult weevils captured in these cages were held for parasite emergence in containers similar to those used by Brunson and Coles (1968).

Bathyplectes cocoons recovered from soil-debris samples and those hand-picked in the field were isolated in gelatin capsules and held for emergence of secondary parasites.

The regional locations used in this study are the climatic divisions of the State as recognized by the United States Weather Bureau. Samples were collected from at least two farms in each region. The farms were located in three counties in the northeastern region and in one county in each of the remaining regions (Figure 1). In most cases, two or more fields were sampled on each farm.

Normal cutting dates for the first harvest on the farms sampled in the regions are: mid to late May in the northeastern, southern, and southwestern regions; late May to early June in the north central region; and early to mid June in the central region.

RESULTS AND DISCUSSION

Parasites Found in West Virginia

Five species of parasites have been released in West Virginia. These species and year(s) of release were: *Bathyplectes curculionis* (1961, 62); *Bathyplectes anurus* (Thomson) (Ichneumonidae) (1970, 71, 72), *Dibrachoides druso* (1961), *Microctonus aethiopoides* (Loan) (Braconidae) (1971, 72, 73), and *Tetractichus incertus* (1961). All species except *D. druso* have been recovered. *B. curculionis* and *T. incertus* are considered to be established throughout the State since they were found whenever larval samples were studied. *B. anurus* was collected from most release sites but was not numerous.

M. aethiopoides was not recovered from our release sites but was collected by USDA personnel near Martinsburg, W. Va. (Berkeley County) in May, 1973; it apparently is moving into the northeastern region of the State from release sites in bordering counties of Maryland (R. J. Dysart, personal communication).

Other parasites that have been reared from various life stages of the alfalfa weevil collected in West Virginia were: *Microctonus colesi* Drea (Braconidae), *Patasson luna* (Girault) (Mymaridae), *Anaphes* sp. (probably *pratensis*), *Hyalomyodes triangulifer* (Loew) (Tachinidae), *Spilochalcis albifrons* (Walsh) (Chalcidae), a dipterous sp. (*Helicobia rapax*?), and a mermithid nematode. *M. colesi* and *P. luna* were widespread, while only occasional specimens of the remaining parasites were reared.

Bathyplectes curculionis

Parasitism by *B. curculionis* was never found to be very high in the regions sampled. After our first collection of this parasite in 1969, limited samples of weevil larvae, screened for parasites in 1970 and 1971, indicated low levels of parasitism, e.g. collections from the central region in mid June and late October, 1970 showed 20.3 and 31.3 percent parasitism respectively. An early May, 1971, collection from the northeastern region showed 23.0 percent of the larvae to be parasitized.

Very low levels of parasitism were found in most of the larval collections of 1972 (Table 1). One reason, perhaps, for the low levels observed was that only the largest larvae were isolated; these apparently were the healthy, unparasitized ones. The highest percentages observed were on farms in the central region (Table 1). During the periods of June II and IV, 1972, on Farm 2, percentage parasitism was 54.0 and 88.0 respectively; larvae evaluated on each date (100) were collected only after extensive sweeping. According to the farm manager, weevil populations on this farm had been at sub-economic levels since 1970. Weevil larvae were practically nonexistent on Farm 2 during the periods of October I and III, 1972.

Farm 1 in the central region is the only farm that was sampled throughout the larval season in 1972. *B. curculionis* was present on all sampling dates except during September and the last sampling period in October. There appeared to be two population peaks on this farm—one in early June and the other in early October (Table 1).

Higher percentages of parasitism by *B. curculionis* were found in larval samples collected during 1973 (Table 1). These higher levels were attributed, at least in part, to a more random selection of weevil larvae from the samples; sizes more consistent with the last two instars were selected for isolation. As in 1972, the highest percentage parasitism was observed in samples from Farm 2 in the central region. Parasitism throughout the other regions of the State ranged from 6.7 to 32.0 percent. Although these percentages indicate that *B. curculionis* may be plentiful in many areas of West Virginia, the data also indicate that this parasite is not nearly as abundant as it is in some nearby states such as Pennsylvania and Maryland (Smilowitz et al. 1972). The exception, of course, was the isolated situation encountered at Farm 2 in the central region.

During 1973, it was noted on some farms that weevil populations in pure stands of alfalfa did not reach high levels as early in the season as did populations in mixed stands of alfalfa-brome or alfalfa-orchard grass. Likewise, larval damage in these pure stands did not become excessive until late in the growing season; some farmers were able to harvest these stands first and avoid treatment. Most mixed stands were either treated or needed treatment before harvest. Where mixed and pure stands occurred on the same farm, a comparison of the percentage parasitism showed higher levels of *B. curculionis* in the pure

stands (Table 2). Although the levels were not high, *B. curculionis* was seven to eight times more abundant in pure stands on some farms. The trend in many areas of the State in recent years has been to plant more stands of pure alfalfa.

Hymenoptera Associated with *B. curculionis*

Six species of Hymenoptera were reared from *B. curculionis* cocoons. *Gelis* sp. (Ichneumonidae) was found commonly while *Eupteromalus viridescens* (Walsh) (Pteromalidae), *Spilochalcis albifrons* (Walsh), and *Sceptrothelys intermedia* Graham (Pteromalidae) were rare: all are secondary parasites of *B. curculionis*. Other species that were reared and assumed to be secondary parasites were: *Gambrus ultimus* (Cresson) (Ichneumonidae) and *Itopectis conquisitor* (Say) (Ichneumonidae); both were rare. We are not aware of any previous reports of *I. conquisitor* or *G. ultimus* associated with *B. curculionis*.

Tetrastichus incertus

Our first collection of *T. incertus* was in 1970. Various larval samples from Farm 1 in the central region that year yielded percentages of parasitism ranging from 0.5 to 14.2 in mid June and from 16.1 to 42.8 during early to mid October. No data were collected for 1971 from the central region, and no parasites were found in limited samples from the northeastern region.

T. incertus apparently follows the same pattern of abundance in West Virginia as it does in New Jersey, Pennsylvania, and Maryland; it is scarce in May and early June and more abundant thereafter until the population reaches a peak in October. Samples from Farm 1 in the central region during 1972 indicate that populations of *T. incertus* remained about the same through 1972 (Table 1). Although our data are limited on this parasite, it does not appear to be as abundant in West Virginia as in other eastern states.

Microctonus colesi

This parasite is considered to be widespread throughout the State since it has been dissected or reared from adult weevils at nearly every collection site. In addition, the possible distribution limits as presented by Day et al. (1971) extend well beyond West Virginia boundaries.

M. colesi is not believed to have been present in the State as early as 1961. Of 469 adult weevils collected in Jefferson County in the northeastern region during mid May, 1961, and examined (by dissection) in 1971 none were found to contain *Microctonus* larvae. Our first detection of *M. colesi* was made by dissection of field collected adult weevils from the central region in mid May, 1969. However, it is probable, as suggested by Day et al. (1971), that this parasite had been in the State for several years prior to 1969 and the date of their first collection in Jefferson County in 1970.

Table 1. Parasitism of alfalfa weevil larvae by *Bathyplectes curculionis* and *Tetrastichus incertus* in five regions of West Virginia during 1972 and 1973.

Regional location	Sampling period ^a	No. larvae evaluated (1972)	% parasitism 1972		No. larvae evaluated (1973)	% parasitism 1973	
		B. cur.	T. inct.	B. cur.	T. inct.		
Northeastern							
Farm 1	May II	200	1.0	0	31	9.7	0
	IV	200	0	0	—	—	—
Farm 2	May II	262	1.1	0	15	6.7	0
	IV	300 ^b	1.0	0	240	12.5	0
	V	—	—	—	400	7.2	0
Farm 3	May II	100	1.0	0	100	13.0	0
	IV	100	1.0	0	—	—	—
	V	—	—	—	100	25.0	0
Farm 4	May II	—	—	—	100	32.0	0
	IV	200	3.5	0	—	—	—
Farm 5	May II	100	0	0	—	—	—
	IV	100	3.0	0	—	—	—
Southern							
Farm 1	May II	250	2.0	0	—	—	—
	III	—	—	—	122	11.5	0
	IV	175	8.0	0	—	—	—
	June I	—	—	—	300	9.0	0
Farm 2	May II	200	0.5	0	—	—	—
	III	—	—	—	139	18.7	0
	IV	175	2.8	0.6	—	—	—
	June I	—	—	—	100	21.0	1.0
Southwestern							
Farm 1	May I	346	4.3	0	—	—	—
	II	—	—	—	200	25.0	0
	III	300	8.0	0	—	—	—
	IV	—	—	—	200	15.5	0
Farm 2	May I	200	2.0	0	—	—	—
	II	—	—	—	200 ^c	9.5	0
	III	200	2.0	0	—	—	—
	IV	—	—	—	200	8.0	0
Central							
Farm 1	May III	550	1.6	0	125 ^b	27.2	0
	IV	525 ^b	2.3	0	—	—	—
	V	—	—	—	409 ^c	13.0	0
	June II	432	10.0	0.2	—	—	—
	Aug. II	15	6.7	20.0	—	—	—
	IV	217	1.4	4.6	—	—	—
	Sept. I	98	0	12.2	—	—	—
	Oct. I	135	10.4	33.3	—	—	—
	III	20	5.0	35.0	—	—	—
	IV	5	0	40.0	—	—	—

Table 1 (continued)

Regional location	Sampling period ^a	No. larvae evaluated (1972)	% parasitism 1972		No. larvae evaluated (1973)	% parasitism 1973	
			B. cur.	T. inct.		B. cur.	T. inct.
Farm 2	May III	—	—	—	9	44.4	0
	June I	—	—	—	100	41.0	0
	II	100	54.0	0	—	—	—
	IV	100	88.0	0	—	—	—
	Oct. I	7	42.8	0	—	—	—
	III	2	50.0	0	—	—	—
North Central							
Farm 1	May IV	200 ^e	0.5	0	200 ^d	8.0	0
Farm 2	May IV	—	—	—	100 ^d	11.0	0

^aSampling periods correlate closely with weeks of the month.

^b< 1% parasitism by *Bathyplectes anurus*.

^c1.2 to 1.5% parasitism by *B. anurus*.

^d0.5 to 1.0% parasitism by a mermithid nematode.

^e< 1% parasitism by an unidentified dipteran.

Table 2. Parasitism of alfalfa weevil larvae by *Bathyplectes curculionis* in stands of pure alfalfa and mixed alfalfa-brome-/orchard grass (1973).

Regional location and type stand	Sampling date	% ^a
Northeastern	5/30	
(Farm 2) Pure		14
Mixed		2
	5/9	
(Farm 4) Pure		32
Mixed		13
Southern	5/14	
(Farm 2) Pure		23
Mixed		3
Southwestern	5/11	
(Farm 2) Pure		15
Mixed		4

^aBased on 100 isolated larvae each date.

Samples of adult weevils from the central region in 1970 showed low levels of parasitism by *M. colesi*. Percentage parasitism in 15 adults collected from field debris in late January was 13.3 and of 26 adults captured in field cages in late April 11.5 percent.

Percentage parasitism in 1972 and 1973 was determined by dissecting adults reared from larvae screened for other parasites. This approach was taken because of the low numbers of adults collected from the field and because few parasites emerged from these adults.

Higher levels of parasitism were found in 1972 and 1973 than in 1970 (Table 3). In 1972, parasitism by *M. colesi* was as high as 74 percent on June 11,

Table 3. Parasitism by *Microctonus colesi* in adult alfalfa weevils reared from larvae collected in five regions of West Virginia during 1972 and 1973.

Regional location	Sampling period ^a	No. dis- sected	% para- sitism 1972	No. dis- sected	% para- sitism 1973
Northeastern					
Farm 1	May IV	18	50	—	—
Farm 2	May IV	41	50	155	34
	V	—	—	256	50
Farm 3	May IV	20	45	—	—
	V	—	—	41	27
Farm 4	May IV	21	33	—	—
Farm 5	May IV	18	39	—	—
Southern					
Farm 1	May III	—	—	60	0
	IV	11	36	—	—
	June I	—	—	220	24
Farm 2	May III	—	—	85	0
	IV	11	27	—	—
	June I	—	—	72	49
Southwestern					
Farm 1	May III	17	23	—	—
	IV	—	—	75	12
Farm 2	May III	20	15	—	—
	IV	—	—	96	14
Central					
Farm 1	May III	75	0	70	0
	IV	11	9	—	—
	V	—	—	255	29
	June II	95	74	—	—
Farm 2	May III	—	—	5	0
	June I	—	—	51	14
	II	14	14	—	—
North Central					
Farm 1	May IV	20	55	90	19
Farm 2	May IV	—	—	33	21

^aSampling periods correlate closely with weeks of the month. No parasites found in samples collected during May I and II both years.

Farm 1 in the central region. Percentages of 50 or more were found in the northeastern region Farms 1 and 2 on May IV, 1972, and the north central region on Farm 1, May IV. Parasitism in other regions ranged from 0 to 45 percent.

Overall, parasitism by *M. colesi* was higher in 1972 than in 1973. Mean parasitism in 1972 for all regions, farms, and dates was 38.2 percent, while in 1973 it was 26 percent.

Patasson luna

This parasite was first reared from overwintering eggs of the alfalfa weevil during 1968-69. *P. luna* was generally not found in abundance but in some collections, a relatively high percentage of eggs were parasitized (Tables 4 and 5). Mean parasitism of 1968 fall-laid eggs ranged from 0.1 to 1.5 percent, while in collections of spring-laid eggs it was slightly higher, 0.8 to 4.4 percent. Higher percentage parasitism was found during 1969-70; mean parasitism of fall-laid eggs ranged from 2.3 to 7.7 percent and spring-laid eggs from 0.9 to 10.9 percent.

Table 4. Parasitism by *Patasson luna* of fall- and spring-laid alfalfa weevil eggs in Preston County, West Virginia, 1968-69.

Field number	Percentage parasitism							
	Fall-laid eggs					Spring-laid eggs		
	Nov. 21	Dec. 16	Jan. 16	Feb. 11	Mar. 10	Apr. 29	May 12	May 21
1	0	0	0	0	0	0.3	0	1.2
2	0	0	0	0	1.9	0.7	0.8	4.2
3	2.4	0	0	4.7	2.3	0	0.2	8.0
4	0	0.3	0.3	0.4	0	3.5	1.3	4.4
(Mean)	(0.6)	(0.1)	(0.1)	(1.5)	(1.0)	(0.8)	(0.7)	(4.4)

Table 5. Parasitism by *Patasson luna* of fall- and spring-laid alfalfa weevil eggs in Preston County, West Virginia, 1969-70.

Field number	Percentage parasitism						
	Fall-laid eggs					Spring-laid eggs	
	Nov. 18	Dec. 16	Jan. 28	Feb. 24	Mar. 19	May 14	May 28
1	0	0	1.6	0	4.7	1.5	10.9
2	0	0	0	0	0	1.2	—
3	0	3.0	0	0	5.2	1.2	—
4	12.2	0	15.9	4.6	36.8	0	—
5	8.5	0	0.7	50.0	7.7	2.4	—
6	29.7	18.6	3.0	0	0	0	—
(Mean)	(6.5)	(2.3)	(2.4)	(2.4)	(7.7)	(0.9)	(10.9)

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